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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,631	11/08/2003	Dawn Hopper	0180147	4762

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EXAMINER	
DEO, DUY VU NGUYEN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 06/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/705,631	HOPPER ET AL.	
	Examiner	Art Unit	
	DuyVu n. Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *14-20* is/are allowed.

6)☒ Claim(s) *1-3 and 5-13* is/are rejected.

7)☒ Claim(s) *4* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/18/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-3, 5, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (US 6,452,273) and Chong et al. (US 2002/0045355).

Kim teaches a method for forming a semiconductor device comprising: depositing a polysilicon layer 114 (claimed barrier layer) on a sidewalls of a contact hole defined in an oxide dielectric layer 110; removing a portion of the barrier to expose the silicide layer at the bottom of the contact hole (col. 3, line 65-25). Unlike claimed invention, Kim doesn't describe removing a native oxide situated at a bottom of the contact hole to expose the silicide layer. Chong teaches that native oxide is known to form on the silicide layer before forming other conductive films (paragraph [0008]) and it must be removed with H2 gas to expose the silicide before forming other conductive films (ab., paragraph [0012]). It would have been obvious for one skilled in the art to modify Kim in light of Chong's teaching because Chong teaches to remove the native oxide to clean the silicide layer and improve the reliability of the semiconductor device (ab.; paragraphs [0011,0016,0017]).

Referring to claim 2, Chong also shows removing the native oxide by sputtering is known to one skilled in the art (paragraph 0008). Therefore, it would have been obvious for one skilled in the art to remove the polysilicon using any known method in the art including sputtering

etching to remove the polysilicon with a reasonable expectation of success (please also see Graettinger cited below).

Referring to claim 3, since the polysilicon covers the top corner regions of the dielectric layer and the contact hole; therefore, the top corner regions would not be etched during the removing the polysilicon and the native oxide layers.

3. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim and Chong as applied to claim 1 above, and further in view of Jin et al. (US 2001/0012695).

Referring to claim 6, using other materials such as Ti/TiN is known to one skilled in the art as shown here by Jin (paragraphs [0007,0015]). Therefore, it would have been obvious for one skilled in the art use Ti/TiN materials because they are used to formed barriers for the bit line of a semiconductor device as taught by Jin (paragraph [0015]).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. Claims 8-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Chong et al. (US 2002/0045355).

Chong describes a method for forming a semiconductor device comprising: removing a native oxide layer, by a H2 process, over a silicide layer at a bottom of a contact hole, which is defined in a silicon dioxide layer having top corner regions; depositing a second metal layer 132 (claimed barrier layer) in the contact hole (paragraphs [0007,0032,0070,0071]; figures 7, 8).

Referring to claims 9 and 10, the process would not etch the top corner regions and increase the contact hole with since it is done by the same gas as that of claimed invention.

Referring to claims 11-13, even though Chong is silent about the silicon dioxide comprises PECVD oxide, the barrier layers comprises Ti/TiN and the native oxide comprises thermally grown oxide; however, these techniques of forming silicon dioxide, native oxide and using Ti/TiN are well known to and used by one skilled in the art in the process of making a semiconductor device (please see cited art below).

6. Graettinger et al. (US 6,806,187) is cited to show sputtering prior art (col. 5, line 32-41; col. 6, line 5-13.).

7. Wolf et al. is cited to show PECVD oxide, and thermally grown oxide.

8. Chen et al. (US 6,010,958) is cited to show the use of Ti/TiN as barrier (col. 4, line 14-16).

Allowable Subject Matter

9. Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 4 is allowable because applied prior art doesn't suggest the step of depositing the barrier layer on the sidewalls of the contact hole is optimized such that the barrier layer has a greater thickness at a to of the contact hole than a thickness at a bottom of the contact hole.

10. claims 14-20 are allowed because applied prior art doesn't teach or suggest removing the native oxide situated over the silicide layer at the bottom of the contact hole by utilizing a sputter etch/deposition process.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner
Duy-Vu N. Deo
6/20/05